VOLUME 2 — NUMBER 1

DECEMBER 15, 1943

FIELD SERVICE BULLETIN

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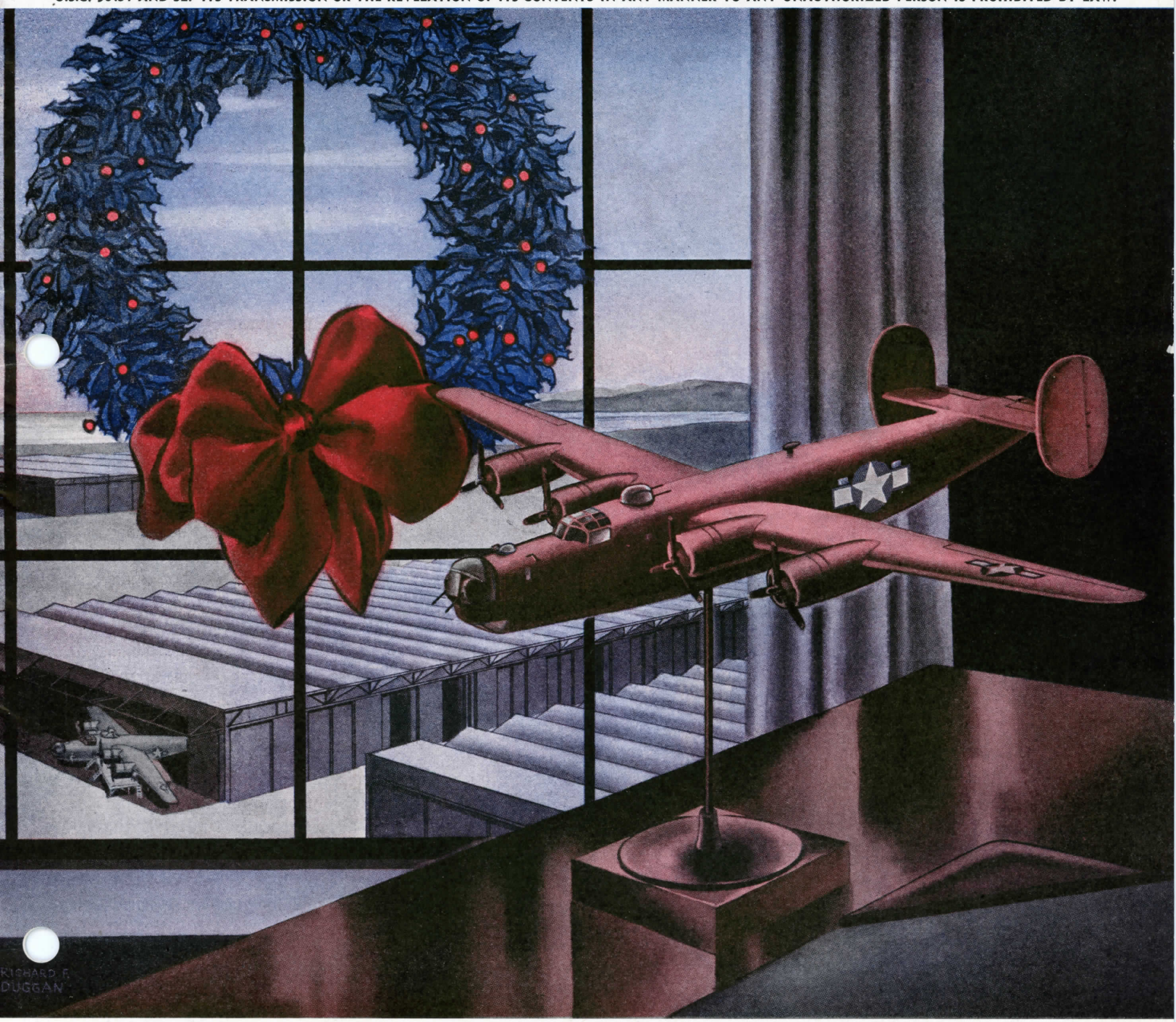

CONSOLIDATED VULTEE AIRCRAFT CORPORATION

San Diego, California, U. S. A.

VOLUME 2 NUMBER 1

FIELD SERVICE BULLETIN

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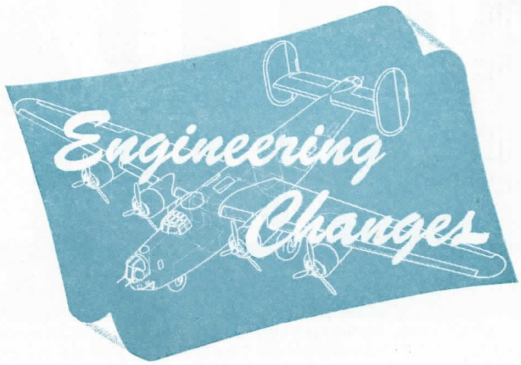

Materiel Command has directed that plywood boxes replace metal boxes used for side gun ammunition stowage. This action, scheduled to become effective with B-24J airplane Serial No. 42-100036, is taken to conserve metal and to aid in weight reduction. A weight decrease of 1.5 lbs. per box is accomplished. (MCR 238.)

Beginning with B-24J airplane Serial No. 42-99936, the thermocouple leads and splice on each engine are relocated, and the splice is changed to a quick disconnect fitting. This revision and relocation facilitates assembly on the engine and simplifies servicing. (MCR 479)

The voltage regulator sub-bases are now installed in B-24 airplanes in such a manner that when carbon pile voltage regulators are used, the axis of the carbon pile is in a vertical position. Carbon pile regulators will not operate satisfactorily when placed in a horizontal position, and the life of these regulators is materially shortened by this condition.

Repositioning of the regulators is scheduled to begin with B-24J airplane Serial No. 42-100185. (MCR 402B)

Provision has been made for the addition of guards to protect the aileron cable tension regulators from fouling on the structure, and to serve as guides for the cable. Guards have been installed for some time on the elevator control cable.

The aileron cable tension regulator guards are scheduled for B-24J airplane Serial No. 42-100236. (MCR 327)

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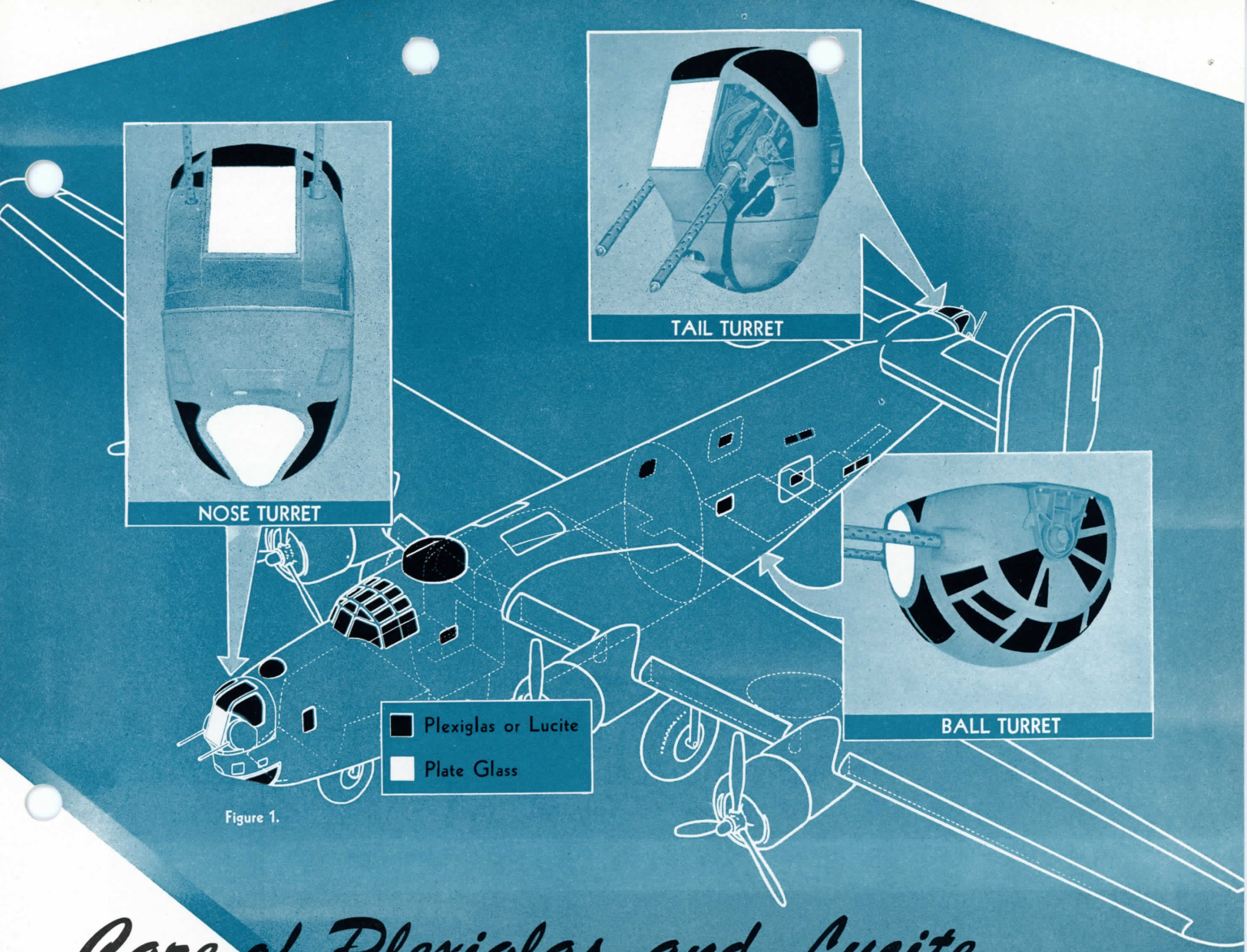

Figure 1.

Care of Plexiglas and Lucite

BECAUSE Plexiglas and Lucite are organic plastics which cannot be cleaned by the same methods or with the same materials used for cleaning ordinary glass, special care should be given to maintenance of Plexiglas and Lucite installations on all Consolidated Vultee airplanes.

Cleaners for some cellulose plastics contain a solvent and an abrasive. Since Plexiglas and Lucite are not cellulose plastics, and since they are affected very little by exposure, such solvents and abrasives not only are unnecessary but definitely can be harmful in cleaning organic plastics.

Cleanup After Using Masking Paper

The adhesive now used on paper for masking Plexiglas has a synthetic rubber base rather than a natural rubber base. The adhesive characteristics of the new base have been increased. In removing the masking paper, some solvent (such as TS28 Shell Oil Company aromatic solvent) on a soft cloth may be applied along the adhesion line. If there is an excess of tar composition deposited on the surface of the Plexiglas from the tar center paper, this may be removed with a dilute solution of isopropyl alcohol. Neither of these solvents will injure in any way the surface of Plexiglas, but will accelerate an efficient cleanup.

Cleanup, General

For this type of cleaning nothing superior to soap and water yet has been found. Best results are obtained by washing Plexiglas and Lucite surfaces with soap and water, using bare hands for application and subsequent cleansing. A dilute water solution of a synthetic wetting agent also is effective, and kerosene likewise can be used to remove grease and oil.

If kerosene is used, it is recommended that surfaces be cleaned off with water and soft rags afterward to remove excess kerosene.

It is not difficult to distinguish between Plexiglas, or Lucite installations and plate glass installations. Plate

(Continued on page 4)

Care of Plexiglas and Lucite

(Continued from page 3)

glass is much harder, and nearly twice as heavy in actual weight. An edgewise examination usually will reveal their differences.

WARNING: Do not use acetone, ketone, lacquer thinner, synthetic paint thinners, brush wash, car wash, paint remover, deicing fluid, benzene, or carbon tetrachloride, as these definitely will soften, decompose, ruin, mar, check, or craze Plexiglas and Lucite. Kitchen scouring compounds also are harmful.

NOTE: Specific recommendations regarding types of solvents, cleaners, buffing compounds, waxes and other items necessary to proper care of Plexiglas can be secured from Consolidated Vultee Aircraft Corporation, San Diego division.

EFFECT OF VARIOUS CHEMICALS ON PLEXIGLAS AND LUCITE

CHEMICAL	EFFECT
acetic acid	Not attacked by concentrations of less than 50%
acetone	Readily attacked
acetylene	Inert
alcohol	Slowly attacked
aluminum sulfate	Not attacked
ammonia	See ammonium hydroxide
ammonium chloride	Inert
ammonium hydroxide	Inert toward all concentrations but may yellow
ammonium nitrate	Inert
ammonium sulfate	Inert
aniline	Attacked
amyl acetate	Attacked
aqua regia	Attacked
aromatic fuel	Attacked
battery acid	Inert
benzene	Attacked
brine	Inert
butane	Inert
butyl alcohol	Attacked
carbonic acid	Inert
carbon bisulfite	Attacked
carbon dioxide	Inert
calcium hypochlorite	Inert
carbon tetrachloride	Attacked
caustic soda	Not attacked by concentrations less than 25%
chlorinated hydrocarbons	Generally attacked
chloroform	Extensive solvent action and softening
city gas	Inert
coconut oil	Inert
copperas	Inert
cresol	Attacked
esters	Generally attacked
ether	Attacked
ethyl acetate	Rapidly attacked
ethyl alcohol	Absorbed during prolonged contact causing some softening of the resin
ethylene glycol	Inert
ferric sulfate	May discolor but otherwise not attacked
formaldehyde (formalin)	As a water solution, inert
formic acid	Attacked
fuel, aromatic	Attacked
gasoline	Slightly attacked if the gasoline contains benzol or tetraethyl lead
gelatine solution	Inert
glycerine	Inert
glycol	Inert
hexane	Inert
hydrochloric acid	Inert to weak solutions
hydrofluoric acid	Slightly attacked and crazed
hydrogen	Inert
hydrogen peroxide	Inert to 3% solution of H_2O_2
hydrogen sulfide	Inert
iodine, tincture of	Swells and becomes soft and rubbery
isopropyl alcohol	Soluble in concentrated solutions; inert to dilute solutions
kerosene	Inert
ketones	Generally attacked
lacquer thinner	Solvent action
lime slurry	Inert
lubricating oil	Inert
"Lysol" solution, strong	Turns white
mercuric chloride	Inert
"Mercurochrome"	Stains faint pink
"Merthiolate"	Not affected
methanol	Attacked by solutions in excess of 45% concentration
muriatic acid	See hydrochloric acid
naptha	Inert
natural gas	Inert
nitric acid	Unattacked by dilute solutions up to 10%
nitrogen	Inert
octane, 100	Attacked
"Oakite"	Inert
oxygen	Inert
ozone	Inert but do not suggest use
pentane	Inert
phenol	Attacked
phosphoric acid	Attacked by concentrated solutions
potassium hydroxide	Inert
potassium iodide	Inert
sodium carbonate	Inert
sodium dichromate	Inert
sodium hypochlorite	Inert
sodium metaphosphate	Inert
sodium metasilicate	Inert
sulfuric acid	Inert to concentrations less than 40%
tar acid	Attacked
tartaric acid	Inert
toluene	Readily attacked
trisodium phosphate	Inert
turpentine	Attacked
xylene	Attacked

NOTE: Listed above are many chemicals which, due to their widespread and popular use, may be termed "common." Also listed, for reference purposes, are many other chemicals not so familiarly known. Chemicals in this latter group sometimes are found in solvents.

"Inert" means the chemical does not affect the surface.

WARNING: 100 octane aromatic fuel used in B-24 and PBY airplanes contains xylene, toluene and benzene. All of these chemicals attack Lucite and Plexiglas readily. Do NOT use aromatic fuel for cleaning organic plastics.

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New Type Tires ON PBY-5A DISCHARGE STATIC ELECTRICITY

STATIC conductor tires developed through research in the field of acetylene carbon now are installed on PBY-5A amphibian airplanes. The new tires eliminate the need for static discharge trailing wires previously installed on the airplane.

Frequently the cause of fires and explosions, static electricity long has endangered aircraft on the ground as well as in the air. Sparks from such electricity have been known to jump two-inch gaps between fuel hose nozzles and fuel cell filler necks on aircraft being refueled.

Several Methods Employed

Several methods are used for discharging static electricity from airplanes on the ground. Devices employed include cables and wires extended from the airplane to the ground. The Consolidated Vultee B-24 airplane, for example, is equipped with a spring steel ground wire extended from the bottom of the left hand oleo-fork to the ground. In addition to the ground wire a static discharge trailing wire is scheduled to be installed on B-24J airplanes as an aid in flight to radio reception. (Field Service Bulletin, Vol 1, No. 22, pg. 5.)

Airplanes accumulate static electricity in several ways. By flying through cloud formations which contain a high concentration of static charges, airplanes accumulate such electricity. The airplane's own movement through the air, and the resultant friction of surrounding air passing over the aircraft skin surfaces, produces static electricity. Movement of parts or fluids within the airplane likewise generates static electricity.

Special Carbon Used

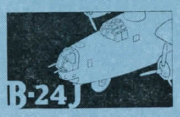
Static conductor tires installed on the PBY-5A contain a colloidal carbon known as Shawinigan acetylene carbon black, impregnated in the rubber in such a manner and in sufficient quantities to conduct static from the airplane to the ground.

This special carbon is combined with rubber in the ratio of from 50 to 60 parts of carbon to 100 parts of rubber. Weight of the carbon in a static conductor tire averages between five and 10 percent of the tire's total weight, depending on the thickness of tread of tire. Thus, in a 12 ply tire weighing 141 lbs., for example, the carbon content would weigh between seven and 14 lbs.

Static conductor tires are efficient under normal operating conditions, though coatings of dry mud, grease, tar or macadam can limit their conductivity. Therefore they should be cleaned, when so coated, to allow their conductive characteristics to function efficiently.

UPPER COWL FLAPS FULL-OPEN POSITION REVISED TO 12¼ DEGREES

Effective On and After



SERIAL NO. 42-73327

DESIGNED to reduce tail buffeting, a modification which revises the full-open position of upper cowl flaps from 22° to 12¼° now is effective on B-24J airplanes. The full-closed position of the upper cowl flaps remains unchanged at 2½° open.

Tests indicated that, with cowl flaps full open, and with full power being employed in a climb, the B-24 airplane was subject to tail flutter. Therefore, the four screw jacks which control the operating mechanism of the upper cowl flaps were modified to operate at one-half the rate of the lower cowl flap screw jacks (figure 2). (MCR 408)

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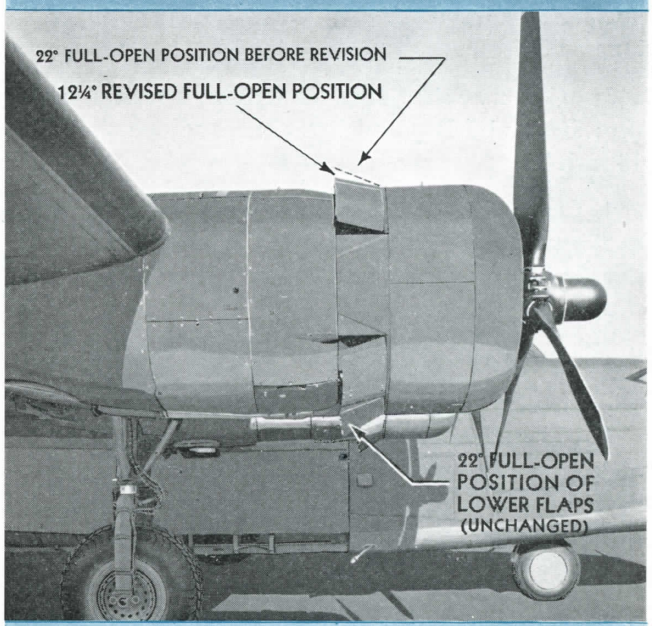


Figure 2. Revised Full-Open Position, Upper Cowl Flaps

USE of torque wrenches in determining proper tightness of Wittek elliptical hose clamps (Type FBE) on fuel cell manifold connections is advised whenever such installations are accessible to torque measuring devices. Torque wrenches are used to insure correct tightness on sub-assemblies made in the factory, and the use of such wrenches in maintenance operations is imperative when possible.

However, these clamps are inaccessible to torque wrenches in certain instances, and their proper tightness then must be judged by visual inspection. In servicing clamps under such circumstances, the following points should be observed:

1. Cold flow should be at least equivalent to or more than that shown in figures 3-A and 3-B. Actual minimum torque should not be less than 6 inch lbs.

2. The tightness indicated in figures 4-A and 4-B is the optimum or most desired tightness. Actual optimum torque should be 10 inch lbs., which is the torque applied on factory sub-assemblies of fuel cell manifold hose and clamps.

3. Cold flow should not exceed that indicated in figures 5-A and 5-B. Actual maximum torque should be 14 inch lbs.

4. Clamps should be installed with the sides flush, as illustrated in figure 4-B. Maximum tolerance from this flush condition is indicated in figure 5-B.

5. Clamp adjusting screws are to be tightened equally. A minimum of 1/8" of threaded area on the screw is to be left available for future tightening if required.

6. Hose clamps are to be installed perpendicular to and centered over each half of the manifold coupling connector. Both halves of each clamp are to be nested together properly.

7. Manifold coupling connectors should be inserted straight, and spaced equally in the hose and cell connector elbow.

8. The manifold coupling connector should be so positioned that neither the manifold connector hose nor the cell elbow is forced against the drain hole riser on the coupling casting. Maximum position is indicated in figure 4-B.

9. Hoses are to be trimmed to proper length to prevent kinking or deforming of outlet elbows, and to prevent bulges in the bottom of the cell.

10. The only lubrication allowable in making hose connections is a soap and water solution. (See note No. 1, CVAC Drawing No. 32G1039.)

11. Minimum clearance between cell outlet elbows and wing structure Z angles is 1/4".

12. Figures 3-A to 5-B, inclusive, illustrate Wittek hose clamps (Type FBE). However, cold flow principles illustrated are applicable to all types of clamps. Special attention should be given installation and servicing of the 28G5190 (PBY type) clamps, when used, to insure that wide portions of the clamps are fitted properly.

13. Improper use of tools to facilitate assembly can result in damage to the inner lining of the hose. Evidence of such damage will render assemblies non-acceptable.

Under certain conditions where it is impossible to use the Wittek (Type FBE-18) clamp, due to space limitations, part No. 28G5190 (PBY type) can be installed. This clamp, shaped like a Wittek clamp, is a single elliptical loop, tightened or loosened by a single bolt and locknut. The bolt is mounted parallel to lower surface stringers, whereas the tightening screw on the Wittek clamp is mounted perpendicular to lower surface stringers.

The PBY type clamp reduces total width of the manifold assembly by approximately 2" in comparison with assemblies where the Wittek device is used. Care should be exercised in installing the PBY type to be sure the locknut is tightened securely after the bolt has been turned sufficiently to tighten the clamp. Caution should be used in installing the clamp to insure that

the elliptical contours of the hose and the clamp exactly coincide before tightening. To determine correct cold flow on this clamp, follow instructions set out in this article for Wittek clamps.

Originally designed for use on PBY airplanes, the 28G5190 clamp is acceptable on B-24 installations. However, its use at present should be limited to emergencies where space limitations prohibit use of Wittek clamps.

Note: AAF inspectors have directed that note No. 7 on CVAC Drawing No. 32G1039, which specifies that optimum torque for these hose clamps should be 17½ inch lbs., is to be disregarded, and also have directed that paragraph 2.0 of Manufacturing Process Specification 23a likewise may be disregarded. Drawings and specifications are being revised to conform with these instructions. (CVAC Inspection Dept. Memo 849.)

MINIMUM COLD FLOW — 6 Inch Lbs.

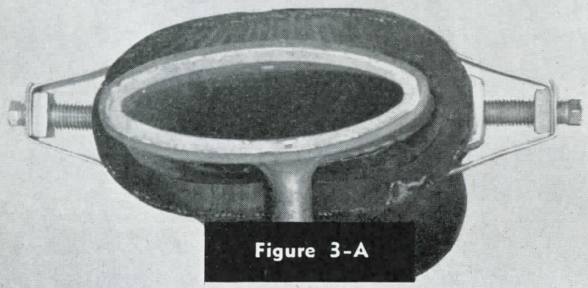


Figure 3-A

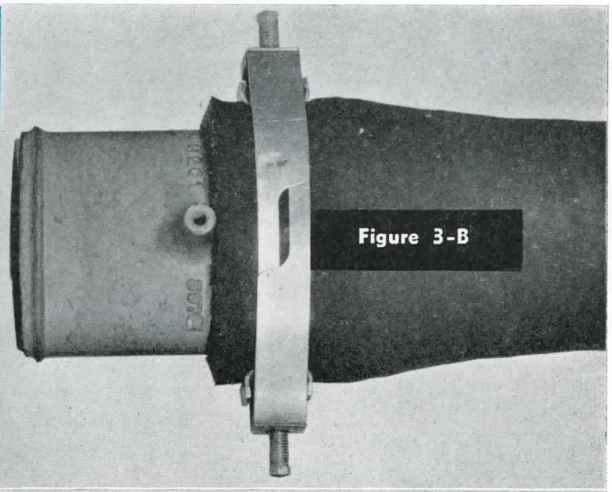


Figure 3-B

OPTIMUM COLD FLOW — 10 Inch Lbs.

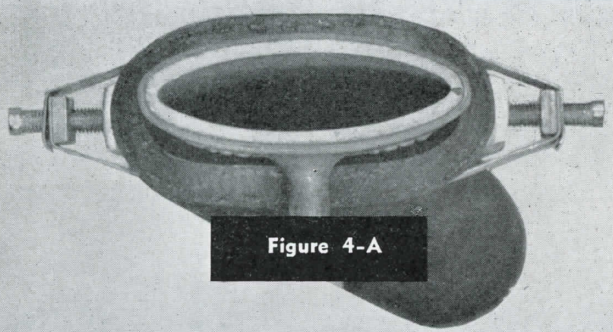


Figure 4-A

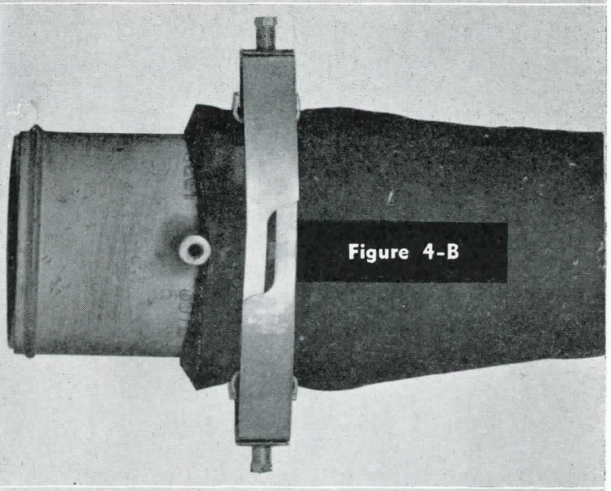


Figure 4-B

MAXIMUM COLD FLOW — 14 Inch Lbs.

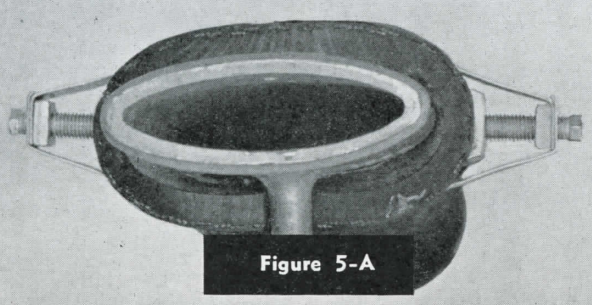


Figure 5-A

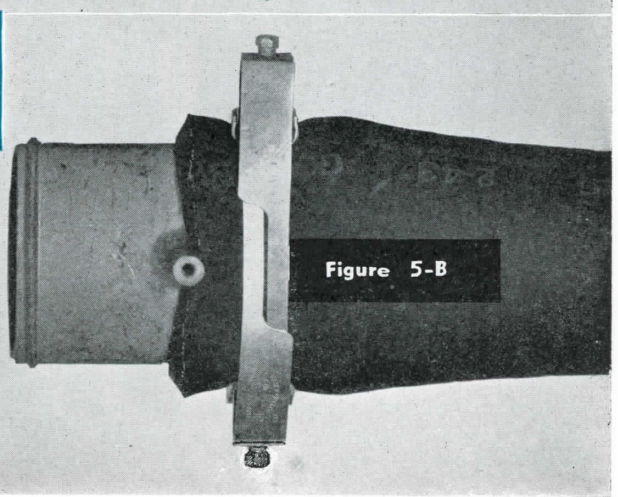


Figure 5-B

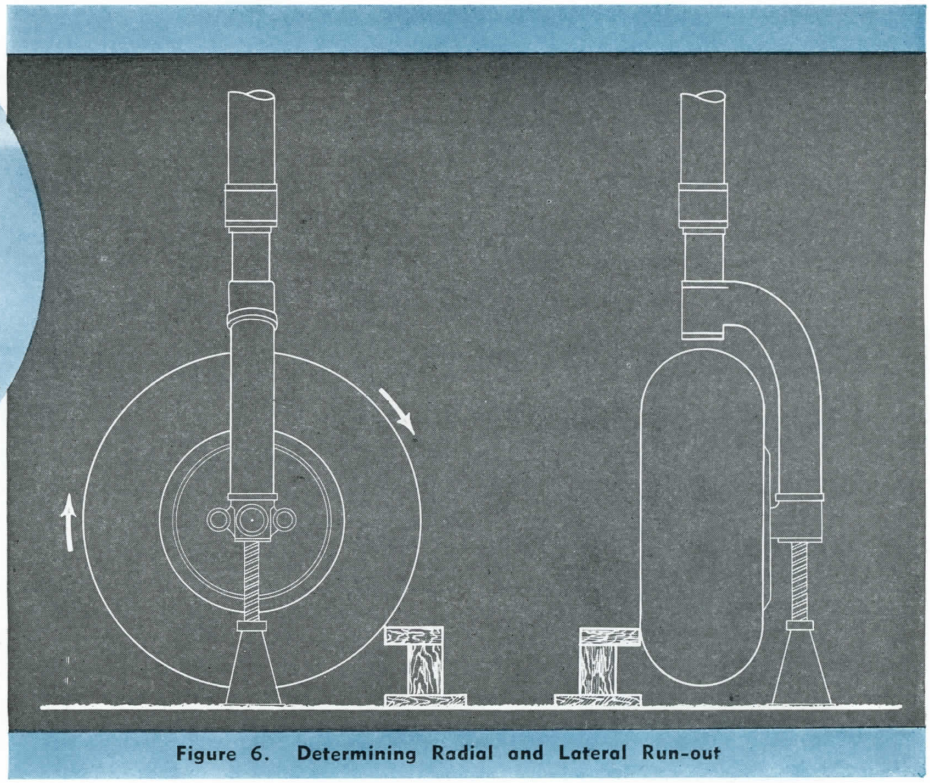


Figure 6. Determining Radial and Lateral Run-out

CORRECT alignment of landing gear is of importance to safe and efficient operation of the B-24 airplane. The tremendous loads carried by the airplane contribute to the severe *shock* during the take-off run, during the landing run, and when the gear initially makes ground contact, and make regular alignment inspections and checks not only advisable but necessary.

The following material on landing gear alignment, scheduled for early publication in the revised edition of Consolidated Vultee's B-24 Airplane General Manual, is herewith published in advance of the manual publication date due to the importance of correct alignment procedure.

Definition of Terms

By definition, the factors to consider in the alignment of landing wheels are:

Camber—The angle between vertical and the plane of wheel rotation, when the wheel tilts outward at the top.

Negative Camber—The angle between vertical and the plane of wheel rotation, when the wheel tilts inward at the top.

Toe-in—The amount the wheels point inward at the front. Usually measured in inches.

Toe-out—The amount the wheels point outward at the front.

Radial Run-out—The difference between the least and greatest radius of the wheel rim or the tire, at the greatest diameter of the wheel rim or the tire.

Lateral Run-out—The total lateral distance a single point on either the wheel rim or the tire moves in one direction during one revolution of the wheel.

Note: The main landing gear is designed for zero camber and zero toe-in.

Note: The nose landing gear is designed for zero camber when the wheel is in direct fore and aft position

Alignment

Proper alignment of landing gear and wheels is essential for safe operation of the airplane. *Run-out, camber, or toe-in* must not be excessive. *Negative camber* and/or *toe-out* should *never* be permitted.

The development of a misaligned condition is indicated by excessive tire wear and/or landing gear shimmy.

Adjustments to Correct Misalignment

Camber—There are no adjustments for correction of wheel camber. A condition of misalignment can be completely corrected only by replacement of faulty structural units of the landing gear.

Toe-in or Toe-out—Toe-in or toe-out sometimes can be corrected by shimming the oleo scissors at the center bolt, or by replacement of the scissors assembly.

Radial Run-out—Radial run-out can be corrected only by replacement of faulty tire or wheel.

Lateral Run-out—Lateral run-out can be corrected only by replacement of faulty wheel bearings, distorted wheel or distorted tire.

Measurement of Run-out—Main and Nose Wheels

Note: Always inspect for radial and lateral run-out before determining camber and/or toe-in or toe-out.

Radial Run-out—Inspect for radial run-out as illustrated in figure 6. First, inspect for radial tire run-out. Then, if radial tire run-out is excessive, measure radial run-out of wheel rim to determine whether the error is in wheel or tire, or both. A condition of radial run-out

must not be excessive or the wheel will oscillate in a vertical direction at high speed.

Lateral Run-out—Inspect for lateral run-out as illustrated in figure 6. If lateral tire run-out is excessive, measure lateral wheel rim run-out to determine whether the error is in wheel or tire, or both. Lateral run-out must not be excessive. Lateral wheel run-out can be due to worn wheel bearings, out-of-adjustment wheel bearing nut, or distorted wheel. Lateral tire run-out is due to a distorted tire.

Note: After determining lateral run-out and before allowing the weight of the airplane to rest on the wheels for measurement of camber, turn the wheel so the point of greatest lateral run-out is 90° from vertical. This procedure permits a more accurate measurement of camber.

Measurement of Toe-in or Toe-out

Note: Always inspect for radial and lateral run-out before determining toe-in or toe-out.

1. Mark a chalk line on the tire as indicated in figure 7. Be certain to use a block to steady the chalk.
2. Scribe a thin line around the wheel in the center of the chalk line to establish a thin line from which to make accurate measurements.
3. Measure dimensions (1) and (2) (figure 8) from airplane center line to the chalk line on one tire, as indicated. To establish the fuselage center line, drop plumb lines from wing station zero. Do not assume that the center of the catwalk lies precisely on the fuselage center line.
4. After measuring dimensions (1) and (2) (figure 8) measure dimensions (3) and (4) (figure 9).

Note: Toe-in or toe-out sometimes can be corrected by shimming the oleo scissors at the center bolt, or by replacement of the scissors assembly.

(Continued on page 10)

MEASUREMENT OF TOE-IN

Figure 7.
Marking Line on Tire

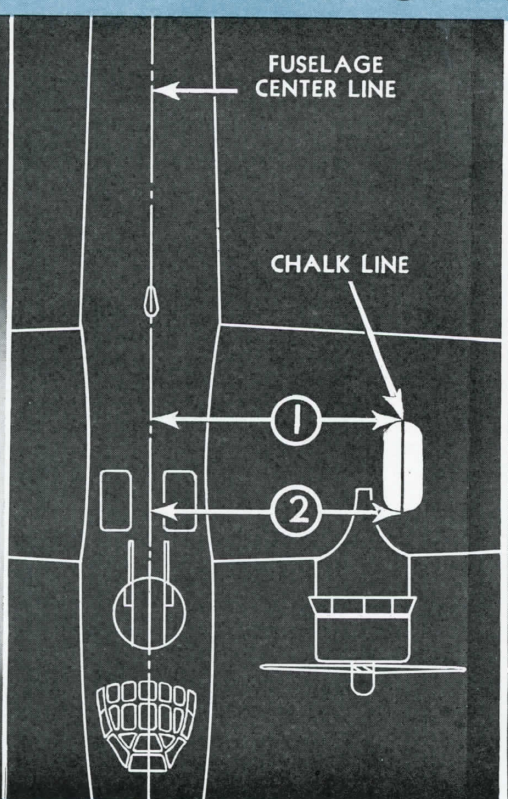


Figure 8.
Measuring to Fuselage Centerline

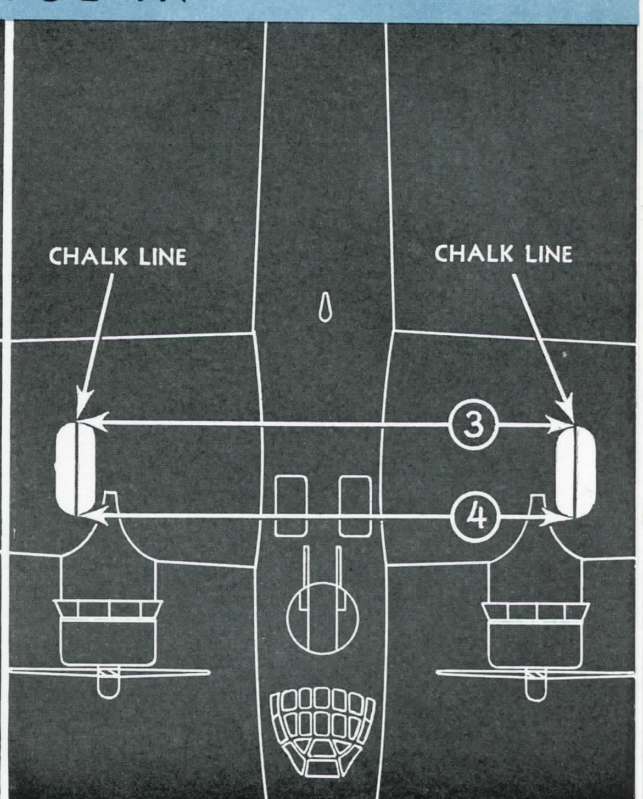


Figure 9.
Measurement — Wheel to Wheel

Aligning B-24 LANDING GEAR

(Continued from page 9)

Measurement of Camber Main Landing Wheels

Note: When measuring camber the airplane *must be level* and the *weight* of the airplane *must* be on the *wheels*.

Note: When measuring camber it is *essential* that the point of greatest lateral run-out be *90°* from *vertical*.

1. Be certain that right and left shock struts are inflated an equal amount (3 7/16″).
2. Level the airplane laterally by jacking up one of the oleo struts. Place the jack under the jack pad at the outboard end of the axle. After leveling the airplane, again inspect right and left shock struts for equal inflation.
3. Place a board or other object under the raised wheel and remove the jack. The airplane should now be laterally level with full weight on the wheels.
4. Camber can be determined in two ways:
   a. Attach a C clamp to the oleo fairing and hang a plumb bob from the clamp. The clamp should be located so the plumb line intersects the extended axle center line. Measure dimensions (5) and (6) (figure 10) to determine wheel camber.
   b. Wheel camber also can be determined by placing a straight edge equipped with spirit level and protractor head vertically against the wheel rim, as illustrated in figure 11. The camber angle can be measured directly with the instrument.

Measurement of Camber Nose Wheel

The nose wheel is designed for 0° camber when the wheel is in direct fore and aft position.

Measure wheel camber by using either of the two methods discussed previously for main landing wheels, and illustrated in figures 10 and 11. Observe the following precautions:

1. Be certain airplane is level laterally.
2. Be certain the plane of the nose wheel is in line with the fuselage center line. If the wheel is turned to right or left, it assumes a measurable camber (due to nose wheel caster).

Inspection of Landing Gear to Determine Cause of Misalignment

Main Landing Gear — Inspect for a sprung axle, bent or partially sheared pivot pins, bent oleo piston, distorted or worn drag strut and side brace strut mounting bolts, bent side brace strut or drag strut, distorted wing attachment fittings, distorted wing auxiliary spars, sheared rivets at the landing gear to wing fittings, or damaged wheel.

Nose Wheel Gear — Inspect for a sprung axle, bent or partially sheared V strut pivot pins, distorted V strut, misaligned drag link bearings, or damaged wheel.

MEASUREMENT OF CAMBER

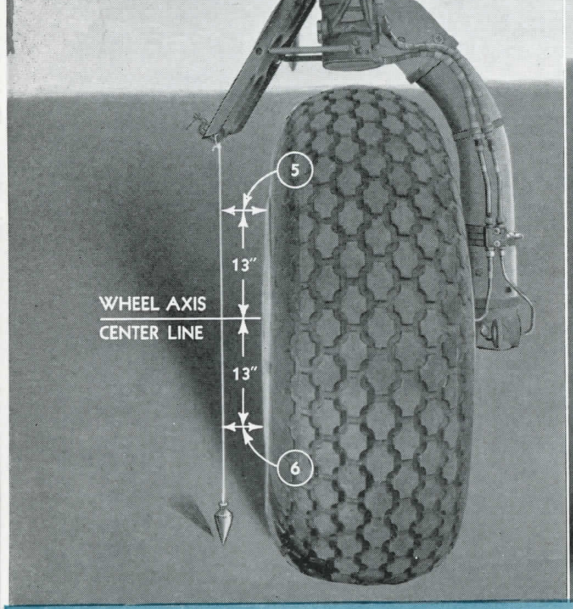
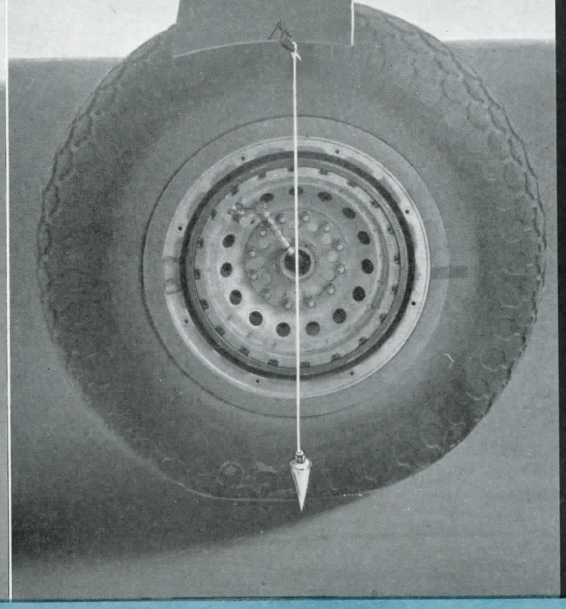


Figure 10. Use of Plumb Bob



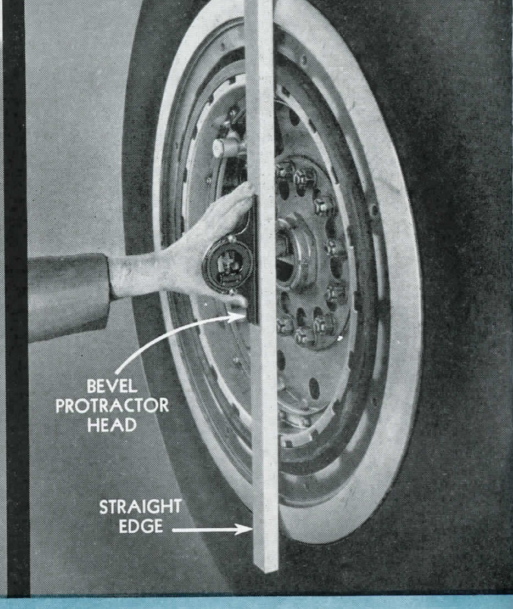


Figure 11. Use of Protractor

General Service Notes

IN RE: *Bleeding and Equalizing Brakes.*

IT IS advisable to bleed and equalize brakes at every 50-hour inspection period even if the need is not indicated. Adherence to this practice will assist in minimizing brake failures.

In general, it is mandatory that brakes be equalized and bled:

1. After replacement or repair of tubing, brake valves, bleeder valves, or expander tubes.

2. When unequal heating of inboard and outboard brake drums or excessive overheating of either brake drum is encountered.

3. After a brake valve linkage adjustment has been changed.

It is recommended that push rod stops on brake valves never be changed after valves are installed in the airplane. Always adjust brake pressure by lengthening or shortening the linkage rods which are connected to brake valve levers.

Frequently bleeding is made necessary by the entrance of air when other parts of the hydraulic system are being repaired. It is often possible after such repairs to avoid the necessity of bleeding the brakes by operating the bomb doors repeatedly from the bomb bay door utility valve, with the auxiliary electric pump turned *on*. This will eliminate air from the accumulator system before it gets into the brakes. Air in the brake system causes dragging of brake and sluggish brake release.

IN RE: *Major Cause of Shimmy and of Excessive Wear or Failure of Scissors on the Main Landing Gear.*

It has been found that numerous cases of shimmy have been due to a loose oleo collar lock nut (the large lock nut immediately above the scissors). Inspect this nut at every preflight inspection to be sure it is properly tightened and secured with safety wire.

IN RE: *Adjustment of End-play in the Main Landing Gear Oleo Pivot and Forward Drag Strut Pivot.*

Allowable end-play in the oleo pivot is .000 to .025 inches. Allowable end-play in the drag strut pivot fitting is .001 to .006 inches. However, it has been found advisable to keep these clearances well below the allowable maximum. Where these clearances have been held to a minimum, it has been determined that wear is minimized and the adjustments do not change, even over extended periods of time. However, be certain not to adjust to clearances less than the allowable minimum or excessive wear and dragging will result. To inspect for excessive clearance, place the airplane on jacks and shake the main landing gear violently in a fore and aft direction.

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Identification of Contact Springs For Magneto and Vibrator Clarified

Investigation has disclosed that three types of magneto springs and booster vibrator contact springs are being used interchangeably on B-24 airplanes, resulting in some confusion and in ignition system failures. Steps are being taken to check this condition.

The three contact springs in use are:

1. Bronze alloy .050″ diameter
2. Steel .034″ diameter
3. Steel .031″ diameter

Use of .031″ Spring Grounds Ignition

All three springs work equally well in the vibrator; but only the .034″ steel or .050″ bronze spring will function properly in the magneto, due to the grounding device built into the magneto. This device is spring loaded, and must be overcome by the opposing action of the spring connector. The .031″ spring, intended for use in the vibrator, will work for a time in the magneto, but its light construction eventually causes it to take a permanent set. This permits the automatic grounding device in the magneto to ground out the ignition system.

Because it is difficult to distinguish one steel spring from the other, steps have been taken to assist in their identification. *Red* lacquer signals are being painted on vibrator springs, and *yellow* signals likewise are marked on magneto springs.

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